

REMARKS/ARGUMENTS

Description of amendments

In the specification, Applicant has replaced the original title with a more descriptive title.

Allowed and allowable claims

Applicant appreciates that the Examiner has indicated claims 2 and 3 would be allowable if they are rewritten to include all of the limitations of the base claim and any intervening claims.

Rejection under 35 U.S.C. §102

Claims 1, 5, 7-10, and 21 were rejected under 35 U.S.C. §102(b) as being anticipated by GB 2328891. For the following reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection.

Rejection of claim 1

In the rejection of claim 1, certain features of the cited art are said to be equivalent to the limitations of claim 1, even though these features are not part of the rotor. In order to better appreciate the distinctions it is thought appropriate to summarize the claimed invention and the actual disclosure of the cited art.

It is intended that the limitations of claim 1 should be part of the rotor and not the housing with and in which it is used. Applicant wishes to protect against the sale of replacement rotors for separators originally made by Applicant, and it is considered important not to unnecessarily limit the claim by references to the separator or conditions pertaining only in use. Some elements recited in the claim are not part of the claimed rotor, and are used only to define the environment in which the claimed rotor is used and the intended use of the rotor. Claim 21, on the other hand, is directed to a separator including a housing and the rotor of claim 1.

Thus claim 1 is directed to a rotor for a separator. The separator for which it is to be suitable is of a form comprising a housing to being formed by a base and cover, in which housing the rotor is/can be mounted for rotation about an axis by some form of drive and supplied with liquid to be cleaned.

The rotor comprises a walled contaminant separation and containment vessel having an impervious radially outer side wall. The rotor has an inlet for liquid and has an outlet passage leading externally of the vessel.

Such structural features per se are commonplace in separators and rotors therefor, such as the one shown in '891, that rotor vessel 20 having an outer side wall 22, inlet formed by tubular member 25 (indicated by reference number 2 in Fig 1) and outlet passage 35.

The presently claimed rotor is not constructed according to a commonplace approach, insofar as claim 1 specifically recites the inlet for conveying liquid to be cleaned to a separation and containment zone at a rate less than liquid can be discharged by the outlet passage. This is different from the usual approach, advocated in the cited reference of the outlet passage being dimensioned to pass liquid only at a lesser rate than the inlet, so that the rotor is in operation filled with liquid and indeed filled with liquid at elevated pressure whereby the pressure drop by emerging liquid across the outlet passage forms a reaction motor to drive the rotor in rotation.

This is significant because it means that in use the rotor of the claimed invention runs not filled with liquid but with the liquid confined to an annular "shell" growing inwardly from the outer wall to a radial boundary set by the outlet passage through which excess liquid drains to prevent the vessel from filling further, that is, the "shell" occupies the above-mentioned separation and containment zone which abuts the vessel outer side wall. The remainder of the vessel thus is forced to have a gaseous atmosphere during operation, so that liquid thus enters the vessel into a gaseous atmosphere and the centrifugal effects of rotation push that liquid towards the outer side wall, there acting to separate denser contaminants from liquid in the shell in the vicinity of the outer side wall.

The remainder of claim 1 details how the rotor inlet is set out to convey supplied liquid (that is much denser than the gaseous atmosphere) to the annular separation and containment zone adjacent the outer side wall where it can be operated upon to effect said contaminant separation.

This conveyance is in contrast to a liquid-filled rotor wherein incoming liquid is presented with a liquid "atmosphere" of similar density and subject to flow behavior that is entirely different.

In more detail, the rotor of '891 shown at 20 is described having a tubular member 25 (indicated as "2" in Fig 1) that surrounds the housing axle 15 and is filled with liquid through a duct 16 on the housing axle 15 from a pressurized source. Liquid flows from the tubular member 25 into the vessel proper through aperture 28, etc, located towards one end 23 of the vessel axially spaced from the outlet passage 35 at the other end 24, and fills the rotor vessel. The outlet passage 35 passes liquid at a rate less than the tubular member 25 is capable of replenishing it, causing the rotor to become filled at elevated pressure so that liquid discharged by way of the outlet passage 35 drives the rotor by reaction thereto. The rotor vessel 20 is divided by a radially extending partition wall 30 that separates the main part of the vessel from an outflow chamber 34 guarding the outlet passage 35, permitting outflow only of liquid that passes through aperture 38 adjacent the tubular member 25 and radially inwardly of the outlet passage. As set out, the liquid supplied and passing via aperture 28, into the rotating filled vessel space is encouraged by axially projecting vanes or the equivalent 40 at one end of the vessel to move (pumped) in a direction radially outwardly towards the peripheral side wall against a radial pressure gradient that also results from rotation, and then is permitted to flow with the pressure gradient both axially and radially inwardly towards the aperture 38 and the outlet passage at the other end of the vessel. Arrows in Fig 4 illustrate this as currents within the liquid filling the vessel.

For the purpose of the invention of '891, the rotor vessel 20 is also divided axially by a funnel-like insert 50 that is at its widest at the end 52 nearest the aperture 28, and at its narrowest (only just clearing the tubular member 25) at the end 53 nearest the outlet passage 35.

The liquid in the vessel, having been made to flow radially outwardly upon entry into the vessel and turned by the pressure gradient to flow axially, encounters the upper surface 51 of the funnel structure across which it flows in a direction having a radially inward component down the funnel. It is at this upwardly facing surface 51 during such flow that denser contaminants are separated from the liquid and by centrifugal force driven against the direction of liquid flow until, upon encountering apertures 57, they pass through the funnel into a containment region of the filled vessel below the funnel structure. The cleaned liquid at surface 51 reaches the bottom and 53 of the funnel from where it can flow to the outflow chamber 34 (separated from the above described parts of the vessel by a partition wall 30) and radially outwardly to the outlet passage 35.

Thus contaminant separation takes place in a region (or zone) of the funnel above the upper face 51 and the containment of separated contaminants in a region below it, each region extending radially from the outer side wall 22 (reached by the top end 52 of the funnel structure) to the aperture 38 in the partition wall (reached by the bottom end 52 of the funnel structure)

In view of the above discussion, Applicant offers the following comments regarding the specific structural differences between claim 1 and the cited art.

Claim 1 requirements: *(i) The vessel to have an impervious radially outer side wall extending about and along the rotation axis to form radially inwardly from the side wall an annular contaminant separation and containment zone, and an outlet passage (disposed radially inwardly with respect to the radially outer side wall and leading externally of the vessel) to define during rotation the radial boundary of an annular contaminant separation and containment zone.*

The structure of '891 has separate separation region (zone) and containment region (zone), above and below the funnel structure respectively; there is no zone that effects both separation and containment. Although the part of the vessel enclosure above the partition wall 30 could be argued to contain a region in which both are effected, the region above the funnel structure is, it will be seen from below, also argued by the Examiner to be an inlet region,

and it cannot be both. Insofar as the radial boundary of said regions (zones) are defined by the outer side wall 22 and partition wall aperture 38, the outlet passage 35 of '891 defines no radial boundary of anything.

(ii) An inlet for conveying liquid to be cleaned to the contaminant separation and containment zone at a rate less than the liquid can be discharged by the outlet passage.

This is not the case with '891 where it is implicit that there is a discharge rate less than inlet rate because it is necessary to fill and maintain pressure in the rotor vessel.

The Examiner points to the supply duct 16 of '891 as equivalent to the rotor inlet of claim 1. However, the supply duct 16 is not an element of the rotor, but of the housing notwithstanding that in use fluid enters the rotor via the supply duct 16. The supply duct 16 does not rotate with the rotor, and stays with the housing when the rotor is removed from the housing.

(iii) The inlet to comprise a liquid collector that define:

an inlet region around the rotation axis (radially inwardly of the outlet passage), and a transfer passage that communicates between the inlet region and the contaminant separation and containment zone, the transfer passage being spaced axially from the outlet passage; and

The liquid collector to comprise:

a divider wall, defining at least in part at one end thereof the transfer passage, and a liquid collection face facing towards the rotation axis arranged to receive liquid introduced in to the inlet at a part spaced axially from the transfer passage and operable to support the liquid radially in response to centrifugal force exerted by rotation permitting it to flow along the wall to the transfer passage.

The Examiner equates the funnel structure 50 of the cited reference with a liquid collector and presumably the funnel structure thus defines an inlet region around the rotation axis. The structure 50 defines an inlet region that extends (radially) outwardly with respect to

the outlet passage to the outer side wall. To suggest an inlet region inwardly of the outlet passage would seem to require a notional radial boundary.

The Examiner also states that an (or each) aperture 57 in the funnel structure is the transfer passage, being axially spaced from the lower part of inlet 16 at which the duct in axle 15 of the housing enters the rotor; that is, the liquid enters the rotor at its bottom end, even though it is within the axle duct. It is believed that such an interpretation of liquid introduction into the rotor is strained and not what the reader skilled in the art would understand, such understanding being that the liquid is introduced into the rotor inlet where it leaves the axle 15, at a point above the funnel structure. Irrespective of the position of liquid introduction relative to any funnel aperture 57, what is claimed is axial displacement from outlet passage and this is shown.

It is a requirement that the transfer aperture be at the end of the divider wall. None of the apertures 57 of '891 is at the end of the funnel structure (because each aperture performs a function in '891 only if it is upwardly and outwardly of a part of the funnel surface across which liquid flows and at which separation occurs).

If the funnel structure is to be a collector defining an inlet region inwardly of the outlet passage, this would seem to be limited by such a notional radial boundary at the position of the outlet passage to be the lower part of the funnel and the transfer passage to be defined by an aperture 57 at the lower end of the funnel.

The funnel structure 50 in forming a collector is also said to comprise the divider wall at the upper face 51, the collection face facing the rotation axis.

Insofar as the transfer passage communicates between inlet region and separation and containment zone, the funnel structure in which the transfer passage is formed must also provide some form of boundary between the inlet region and the separation and containment zone, which zone therefore has to be below the funnel structure and the inlet region above the funnel structure.

However, as discussed above, for requirement (i), separation occurs at the upper surface of the funnel so either the funnel cannot constitute the inlet collector or any aperture 57 cannot constitute a transfer passage according to the claim.

(iv) The divider wall collection face to increase in radial distance from the rotation axis along its length from the liquid introduction part to the transfer passage;

the increase being arranged to cause a component centrifugal force to confine flow over the collection face towards the transfer passage in a direction towards the transfer passage.

The Examiner asserts that '891 shows this and depends upon liquid entering the inlet region below the level of the funnel structure at the bottom of the rotor, discussed in requirement (iii).

That is, if the transfer passage is at the bottom of the funnel it cannot increase in distance from the rotation axis along its length to the transfer passage.

If one takes the view that it is liquid on the collection face that matters in respect of the collection face divergence from the rotation axis, then the liquid is introduced to the face between the upper end and lower end of the funnel and is caused to flow in the direction of radius decrease towards the lower and, (transfer) aperture 57 then the requirement for a component of centrifugal force to confine flow over the wall collection face towards the transfer passage is not satisfied given that the centrifugal force does not have an inward component.

In summary, the cited reference does not teach several limitations of claim 1. For example, it does not teach the inlet of claim 1. The supply duct 16 of the cited reference is not part of the rotor and is not sized to convey liquid at a rate less than the liquid can be discharged by the outlet passage. Additionally, the cited reference does not disclose the structural relationship among the liquid collection (and transfer passage), outlet passage, inlet region, and separation and containment zone.

Rejection of claim 5

Claim 5 requires the rotor to provide an inlet, that is, something that being part of the rotor rotates with it, and for at least the radially outer wall of the separation and containment vessel to be a “module” removable from the inlet components of the rotor.

The Examiner states that in '891 the rotor and elements therein define a module which is releasably attached to inlet 16 via removable cover 13. However, inlet 16 is a spindle forming part of the housing upon which the rotor is mounted; it is not part of the rotor.

The structure of '891 does not provide a rotor [vessel] where the radially outer wall is removable as a module from the remainder of the rotor. Although '891 does mention that the funnel structure may be insertable in, or removable from, a rotor vessel, to simply state that the rotor of '891 has a separate and separable component, the funnel structure, is not grounds for concluding anticipation of the specific configuration claimed.

Rejection of claim 7

In claim 7, the rotor outer wall “module” that is removable is molded of synthetic resin material.

The Examiner, having objected to claim 5 on the ground that the rotor per se is a module, states that “the device may be formed of plastics material” and refers to a passage in '891 that describes the above-discussed funnel structure. Insofar as '891 discloses rotor in which in operation is filled with liquid at elevated pressure and by virtue of spinning at high speed the liquid exerts considerable force on the rotor vessel walls, a funnel structure that sits immersed in liquid without a force across it does not describe a module according to claim 5 that includes the radially outer wall, nor compare with it. Stating that an internal device may be made of plastics material does not equate to making a module that includes the rotor vessel wall of plastics material.

In light of the foregoing remarks, this application is considered to be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the

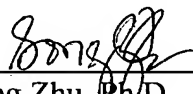
Application No. 10/615,877
Reply dated March 22, 2005
Response to Office Action dated November 22, 2004

undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #100562.52565US).

Respectfully submitted,

March 22, 2005



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